

Spiral Elevator

User/Maintenance Manual



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Content

Preface

Purpose of this manual

Before using the Spiral Elevator, it is mandatory to have read and understood the information in this user manual such as Section 1 'Safety' and Section 6 and Section 6.7 regarding maintenance. The warranty will not apply if the instructions in this manual is not followed.

The purpose of this manual is to describe various operations that are intended for the user to perform.

This document contains remarks that point out a risky or specific situation to the user. In many cases this situation is provided with symbol below.



General warning for danger!



Warning for electrical voltage!



Attention, this is an important notice!

Compliance with the operations described in this document is important in order to prevent dangerous situations and unnecessary damage to the Spiral Elevator.

It is recommended to keep one copy of this manual near the machine and one copy with your technical documentation.

Structure of the manual

The user's manual has been composed in such a way, that a number of operations can quickly and easily be found. This manual does not describe operations that are not intended for the user to perform. The user's manual has been divided into sections which describe a variety of functions including the safety and the safe operation of the Spiral Elevator. It is recommended that this manual is read by all users of this equipment with particular reference to Section 1 on page 3- Safety and maintenance Section 6 and Section 6.7.

Requirements of the user

The Spiral Elevator should only be operated by a person who has become acquainted with Section 1 'Safety', and trained in the use of the unit. The Spiral Elevator should only be installed by persons who have become acquainted with Section 4 'Unload the Spiral Elevator' and Section 5 'Mounting, installation, adjustment'. All users must have read and understood Section 6 and Section 6.7 regarding Maintenance of the Spiral Elevator.



Note! *Maintenance activities on the Spiral Elevator should only be carried out by a technically qualified person. Technically qualified employees means: persons that have received adequate training for carrying out the activities involved.*

1 Safety

The Spiral Elevator has been designed such, that it can be used and maintained in a safe way. This holds for the application, the circumstances and the instructions described in the manual. Any person working with or on this machine should study and follow the instructions. It is the responsibility of the employer to make sure that the employee is familiar with, and follows these instructions.

The company or the country in which the machine is used may require extra safety measures. This particularly applies to the working conditions. This manual does not describe how these are to be complied with. In case of doubt, consult your government or safety officer! FlexLink is not responsible for damage if service on the equipment is not performed in accordance with this user manual.

1.1 System information and symbols

The project number and/or general drawing number (identification number) shall always be specified when communicating with FlexLink with respect to the Spiral Elevator.

Pictogram symbols have been placed on the Spiral Elevator in order to identify to the user certain conditions or provide certain information on components of the Spiral Elevator.



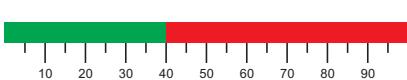
Spiral Elevator machine plate

This contains the name and the address of the initial manufacturer, series or type indication, serial number and the year of construction of the Spiral Elevator.



Gear motor plate

This indicates the gear motor type, applicable voltages, power, oil type etc.



Chain over length sticker

This is a scale, in mm, used to determine if the chain is too long, see Fig. 6.2.1.

1.2 The most important safety conditions

To correctly use the equipment, operators must have appropriate training and/or experience. At the moment that the elevator is going to be operated by a user, the following safety conditions must be met:

- Make sure that children and animals have no access to the machine and its surrounding area by, for example, screenings off elevator with a fence.
- Only persons who have read and understood the operating instructions are allowed to operate, maintain and clean the machine.
- Do not reach into the machine while it is on or running. Even if the machine is not running, it can be “on”, which means start operating automatically.
- Safety provisions, must not be removed or deactivated while the elevator is running.
- Provide good ambient lighting to enable the operator to work well and orderly with the elevator.

1.2.1 General

- Incorrect use of the equipment can cause personal injury.
- Do not stand or climb on the equipment.
- Do not wear clothing or other articles that can fasten in the machine.
- Follow the instructions in the user manual when transporting the machine. FlexLink must approve all modifications or changes to this machine.
- Only use recommended spare parts.
- Only authorised personnel may open electrical units.
- FlexLink is not responsible for damage if service on the equipment is not performed in accordance with this user manual.

1.2.2 Maintenance and Service technicians

Service technicians must have:

- Sufficient knowledge for reading technical information
- Ability to comprehend technical drawings

- Basic knowledge of mechanics
- Sufficient knowledge in the use of hand tools
- Skilled (EN ISO 12100:2010)

1.2.3 **Electricians**

To avoid risks, only experienced personnel with technical knowledge and experience may perform repair work on the machine's electronics components.

Electricians must have:

- Experience from similar installations
- Sufficient knowledge to work from drawings and wiring diagrams
- Knowledge of local safety regulations for electrical power and automations.
- Skilled (EN ISO 12100:2010)

1.3 **Description of safety provisions**

As a standard the Spiral Elevator is not provided with control or any safety provisions. Before putting the Spiral Elevator into service some safety provisions are to be incorporated. The purpose of these safety provisions is to protect the user, the product and the Spiral Elevator against undesired situations (damage).

The following table gives a general description of the safety provisions required. The safety provisions listed in the table are a general guide only. The actual safety provisions to be used must be determined by relevant risk assessment of the overall system.



Note! *Only technically qualified persons should work on, and are allowed to change the settings of the safety provisions!*

Control	Remark
<i>Emergency stop switch</i>	Each Spiral Elevator is to be provided with one or more emergency stop switches that can be operated within reach of the user. The emergency stop switch must make sure that the input and output conveyors or machines are switched off simultaneously.
<i>Motor protection</i>	The technical specification of the Spiral Elevator is, among other things, geared to the load given in the technical specification, quotation or drawing. Should the Spiral Elevator (gear motor) become overloaded, this should be detected by the motor protection in the control system. Without this protection there is a risk that the gear motor or other components of the Spiral Elevator will be damaged and this damage will not be covered by the warranty.
<i>Motor isolation</i>	Means of isolating the motor from the power supply must be provided and within close proximity to the motor.

Operation	Remark
<i>Clean floor surface</i>	With a clean floor surface the operator will not be hindered while operating the Spiral Elevator. This can prevent tripping or slipping, so that the operator does not unexpectedly come into contact with the Spiral Elevator.
<i>Hearing protection</i>	Different tests have shown that the Spiral Elevator does not produce more than 85dB(A)

Mechanical	Remark
<i>Height / width detector</i>	In order to ensure that product cannot become jammed in the Spiral Elevator due to oversize, some automatic checks for width and height can be done. If used this detection must take place before the product enter the Spiral Elevator in order to stop the product or Spiral Elevator.
<i>Transition guard</i>	The basic Spiral Elevator is <u>not</u> supplied with any guarding at the drive / idler ends. A risk assessment should be conducted with consideration to the adjacent conveyors/equipment product etc. to establish any requirements for guarding.
<i>Back flow protection</i>	No accumulation is allowed on the machine; install a back flow protector to shut down the gear drive(s) when there is accumulation. The basic Spiral Elevator is <u>not</u> supplied with back flow protection.

2 Technical specifications

This section lists the technical specifications of the Spiral Elevator. Further product details to which the Spiral Elevator has been designed are contained within the overall Project Documentation (when purchased as part of a Project System).

Use of the Spiral Elevator outside of the scope detailed within the technical specification, quotation or documentation will invalidate the warranty.

2.1 General FlexLink Spiral Elevator specification

- 500 mm inclination per winding (9 degree)
- 3 - 8 windings
- 1 000 mm nominal centre line diameter
- Speed 5 - 60 metres per minute
- Lower height:- 600, 700, 800, 900 or 1 000 mm
 - Adjustable -50/+70 mm
- Max load 10 kg/m (specific Spiral Elevators may be with a lower limit due to actual gear motor used)
- Product size:
 - width= 50 - 200 mm
 - length= 80 - 250 mm
 - height= 1,5 x Length (max 300 mm)
 - see Project Documentation if applicable
- Drive and idler ends are horizontal
- Chain width 100 mm
- Friction top chain
- Steel chain with bearings running on the inner guide rail
- Wet coated mild steel frame
- Column diameter 160 mm
- M8 thread for guide rail

2.2 Technical data

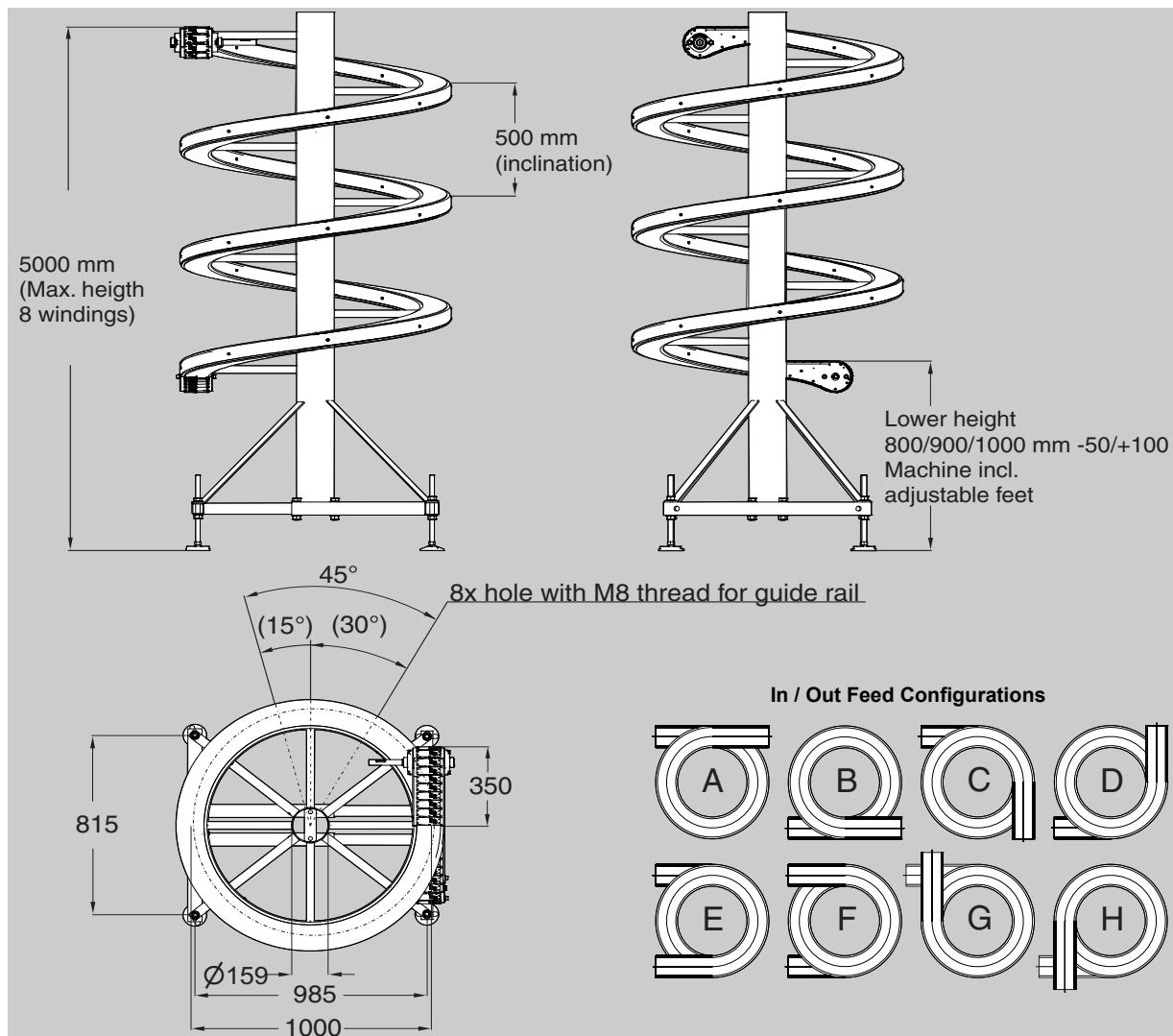


Figure 1 Technical information Spiral Elevator / Configuration

2.3 Ordering information

Example of a Spiral Elevator designation obtained from the FlexLink product configurator:

Item no	A	B	C	D	E	F	G	H	I
5995512	100	- 1000	- 500	- S	- A	- TU	- 800	- 3	- 25

5995512- Item number (Standard)

5995958- Item number (Fast track)

- A Chain width
- B Spiral center of chain diameter
- C Incline per winding
- D Mild steel (S) material configuration
- E Configuration; e.g. A see Fig. 1
- F Transport direction up/down TU or TD
- G Lower height; 600 / 700 / 800 / 900 / 1 000
- H Number of windings; 3 - 8 (Standard)
Number of windings: 3 / 4 (Fast track)
- I Shaft diameter; 20 mm (for gear motor type SA37) / 25 mm (for gear motor type SA47) / 30 mm (for gear motor type SA47)

For more information please contact your local FlexLink office.

2.4 Operating conditions

The circumstances under which the Spiral Elevator can be operated partly depend on the materials selected. FlexLink has defined a number of parameters within which the Spiral Elevator would be allowed to function. Should the Spiral Elevator still be operated beyond these limiting values, FlexLink cannot guarantee the good functioning of the Spiral Elevator.

Ambient temperature (in operation)	0 to +35°C
During transport / storage	-5 to +40°C
Relative air humidity (RH)	30% to 95%, not condensing
Lighting	Normal ambient lighting
Height	Up to max. 2 000 m above sea level

No lighting is installed or can be added as an option on the Spiral Elevator but normal ambient lighting is sufficient to work safely. The Spiral Elevator is not intended for use in an open air environment or in an area with a risk of explosion, although static safe materials are available.

FlexLink should be contacted and consulted if any doubt regarding the operating conditions.

3 Function and components

This section deals with a number of general matters with respect to the Spiral Elevator. This involves, among other things, the purpose of use, the conditions of use and the working principle of the Spiral Elevator. Should you have any further questions on the safe operation of the Spiral Elevator please contact FlexLink.

The warranty conditions have been included in the FlexLink quotation or are available separately from FlexLink.
FlexLink does not accept any liability for unsafe situations, accidents and damages resulting from:

- Neglect of warnings or stipulations as displayed on the machine, in this manual or in the Project Documentation (if applicable).
- Use in applications or circumstances other than those specified in this manual, the quotation, the Project documentation (if applicable), or FlexLink catalogue.
- Modifications to the machine. This also includes the use of replacement parts other than those specified and supplied by FlexLink. For recommended spare parts see Appendix F.
- Insufficient or incorrect maintenance.

FlexLink does not accept any liability for the consequential damage in case of failures of the machine, for example damage of products, interruption of operation, etc.

3.1 Purpose of use

The purpose of use of the Spiral Elevator is to transport products / goods in a vertical direction. This may be for bridging a difference in height or for functioning as a cooling buffer.

It should not be used for transporting products with parts that are protruding, hanging loose or for transporting products that result in a higher load than mentioned in the documentation. Neither for transporting products with measurements deviating from the data given in the technical specification associated with the particular Spiral Elevator. Contact FlexLink if any doubts.

Additionally it is not permitted to walk, stand or sit on the Spiral Elevator or to stick objects or body parts between the guards, slats or other moving parts.

3.2 Description of the Spiral Elevator

The Spiral Elevator is applied in a (transport) system where products can be transported vertically in a relatively small area. The height of the Spiral Elevator is dependant upon the low level height plus the number of windings of the spiral see 'Technical specifications' on page 7. The Spiral Elevator can be coupled to other transport systems and be built according to the customer's needs.

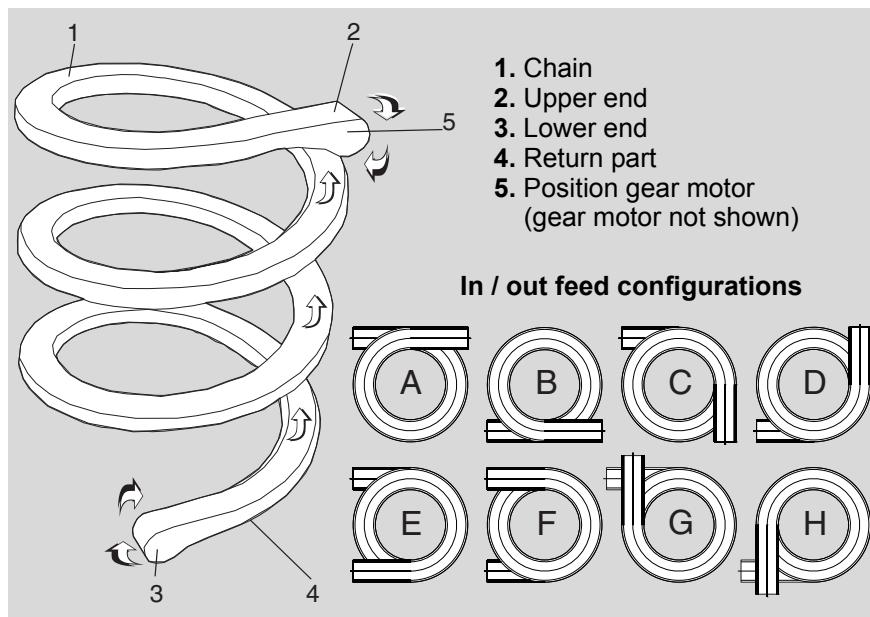


Figure 2 Principle sketch (Transport direction up) / Configuration operations

Before the Spiral Elevator is put in to service a suitable Risk Assessment should be completed.

After integration / installation the Spiral Elevator should not be relocated without further Risk Assessment.

3.2.1 Configuration input / output

In most cases the Spiral Elevator is integrated into a system. The input / output side of the Spiral Elevator is determined dependent on the system. The configuration of the Spiral Elevator is available in different formats with regard to input / output positions. These configuration types are expressed in the letters A to H see Fig. 2. For any special configurations please contact FlexLink.

In following example, it is assumed that the input is at the lower end of the Spiral Elevator and that the product will bridge a difference in height in order to continue the required transport on the output.



Input end

The product is transferred onto the input of the Spiral Elevator. The gear motor drives the chain with the required speed.



Transport of Products

Subsequently, the product on the chain will travel around the Spiral Elevator and bridge the height difference between input and output.



Output end

When the product arrives at the output of the Spiral Elevator it will continue along the system. The chain returns in the underside of the Spiral Elevator to the input position.

3.2.2 Components and parts Spiral Elevator

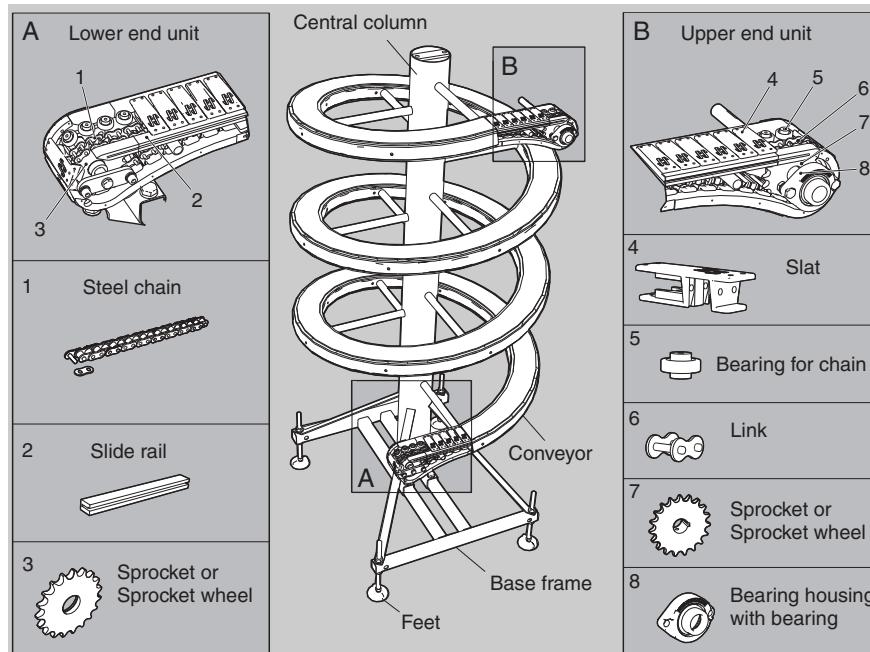


Figure 3 General terminology Spiral Elevator components and parts

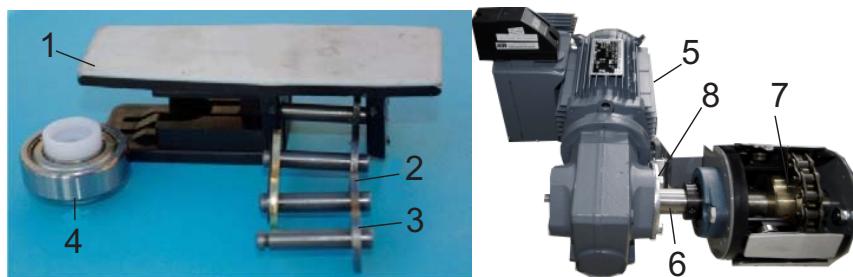


Figure 4 Components conveyor chain, conveyor drive end and gear motor

1. Slat	4. Bearing
Narrow plastic slat provided with a bearing. The slats are mounted in a row on the steel chain and so form the transport surface.	Bearing for the slat
2. Steel chain	5. Gear motor
This is a laterally flexible steel chain on which the slats are mounted.	Optional
3. Link	6. Drive shaft
Links of steel chain	7. Sprocket wheel
	8. Torque arm
	Type specific dependent upon gear motor type

Chain (slats)

The chain consists of a steel chain, connecting links and slats with bearings

(Fig. 3 and Fig. 4). The top of the slat has a high friction material to ensure no sliding of products on the chain. The chain rotates in a spiral form around the central cylinder and is guided on the plastic slide rail. The chain is driven by the gear motor.

Frame

The basic frame of the Spiral Elevator consists of a central column, an upper end (B), a lower end (A) and a base frame that is attached to the floor surface see Fig. 3. Both the upper and lower end may function as the input or output part.

Gear motor

In Fig. 3, the gear motor (in Fig. 4) is mounted on the drive shaft in the Spiral Elevator's upper end. The standard Spiral Elevator is not delivered with a gear motor. However a gear motor may be added as a part of the supply contract. Suggested gear motor specifications can be obtained from the FlexLink Configurator or from FlexLink.

The gear motor requires a Torque arm kit and a Absorber kit to prevent rotation and two types are available as follows:

- For SA37 type gear motors,
 - Torque arm kit = 5057039
 - Absorber kit = 5113736
- For SA47 type gear motors
 - Torque arm kit = 5050459
 - Absorber kit = 5113736

On the driving shaft a sprocket wheel has been mounted that is connected to the steel chain see Fig. 4.

Guide rail, optional

The guide rail ensures that the transported products follows the chain and prevent them from falling off the Spiral Elevator.

3.3 Control units

As a standard the Spiral Elevator is delivered without any control system. It is the responsibility of the system integrator / installer to design a suitable control system.

It is preferable to install an isolating switch (Fig. 5) for the gear motor and it should be of a type able to be padlock off. With this switch the power to the gear motor can be switched / locked off in order to ensure safe working on the Spiral Elevator.

The designer of the Control System should evaluate the requirements of other devices such as Emergency stops etc. in order to provide a safe working system.



Figure 5 Example of an isolator

3.4 Accumulation protection

No accumulation is allowed on the Spiral Elevator. To prevent accumulation jams, a sensor should be installed on the in-feed conveyor, before the Spiral Elevator, and on the out-feed section of the Spiral Elevator to measure product spacing. When product spacing is no longer detected the sensor should switch off the drive motors of the in-feed belt, Spiral Elevator and out-feed belt.

4 **Unload the Spiral Elevator**

4.1 Preparation

Before starting the unloading, good preparation is required. The appropriate devices must be available. The Spiral Elevator must be visually checked:

- Before off-loading from the delivery vehicle.
- Immediately after off-loading.
- Immediately after unpacking.

Any damage must be detailed on the delivery note before signing for acceptance of delivery and also notified to FlexLink in order to possibly progress any warranty claim.

Details of the dimensions and technical specifications are available on one or more of the following:

- Technical specification
- Quotation
- Drawing
- Order

Any deviation must be notified to FlexLink immediately.

4.2 Unloading instructions

Initially the Spiral Elevator should be removed from the delivery vehicle by lifting the Spiral Elevator complete with any pallet base and / or packing materials.

Before starting unloading, all fastening means, securing belts, screws, etc. that secure the Spiral Elevator onto the transport vehicle, must be removed.

It is preferable to move the Spiral Elevator complete with any pallet base and / or packing materials to an area near to the final position and then unload the Spiral Elevator and place it directly on the floor whilst taking care not to cause any damage to the painted surfaces.

The Spiral Elevator's delivered horizontally or vertically dependent on the dimensions. If vertically delivered it can be lifted using a forklift under the

base frame or by using a sling and suitable eye bolt in the top of the central column.

If the Spiral Elevator is delivered horizontally, it can be lifted using a truck with forks spaced wide apart and inserted under the horizontal central column. Soft packing should be used between the forks and the central column to avoid damage and marking. Care must be taken to avoid the Spiral Elevator rolling whilst on the forks. Alternatively slings can be used and attached to two positions around the central column see Fig. 6.

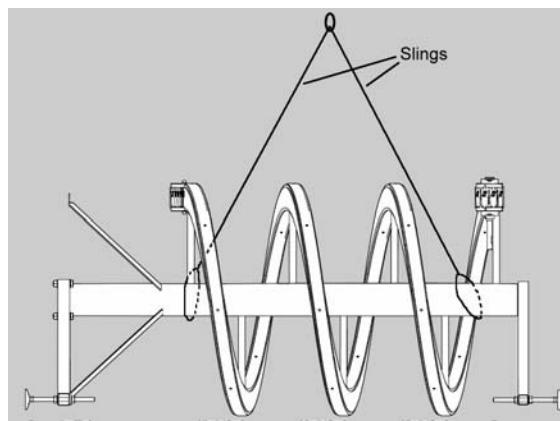


Figure 6 Illustration using slings.

4.2.1 Erecting the horizontally delivered Spiral Elevator

This is relevant for taller Spiral Elevators which are transported in the horizontal position, Fig. 7.



Warning: *It is forbidden to walk under the Spiral Elevator during the procedure of rising the Spiral Elevator.*



Note! *Make sure there are no unauthorized persons near the Spiral Elevator while rising the Spiral Elevator.*

Before raising to upright, be sure that there's enough space / height to rise the Spiral Elevator. When rising or moving the Spiral Elevator make sure that the floor is level, clean and has sufficient load carrying capacity. It is generally safer to move the Spiral Elevator to a position close to the final area, with the Spiral Elevator remaining on the delivery packing (where applicable). Dependent on the situation, the Spiral Elevator can be raised to upright using a hoist, a crane or a forklift.

Procedure, typical method utilizing a hoist:

Carry out these operations calmly in order to be able to carefully monitor any movement of the Spiral Elevator.

- The hoisting device is to be fastened to the cylinder at the top of the Spiral Elevator, Fig. 8. Whilst hoisting, the hoist should be well fixed and aren't to be able to ride/shift away unexpectedly. Use lifting eyes and shackles if no bar in top of column see Fig. 9
- Raise the top of the Spiral Elevator around 200 mm and stop.
- Remove the frame with feet which is temporarily mounted to the Spiral Elevator column top, Fig. 10.



Figure 7 Spiral Elevator in transport position



Figure 8 Hoist fastened to column top under bar in top of column



Figure 9 Using lifting eyes and shackles in top of column. (Lifting eyes and shackles to be supplied by customer)



Figure 10
Remove upper part of frame

- Raise the Spiral Elevator until lifted completely from the floor, see Fig. 11. Take care not to put excessive side load on the feet to avoid bending or damaging them.



Note! Be aware that the Spiral Elevator may tip at the moment it is near to the upright position Fig. 12.

- Remove feet which now is in a horizontal position (Fig. 13) and re-fit to the other holes in the frame to have the feet in the vertical position Fig. 14. Set the adjusting feet to the lowest height for a minimum risk of damage, Fig. 14.



Figure 11 Lifting Spiral Elevator



Figure 12 Risk of tipping when almost vertical



Figure 13 Dismount the adjusting feet from transport position



Figure 14 Remount and set the adjusting feet

- Re-attach the frame with feet Fig. 15, to the final position at the bottom of the Spiral Elevator column. Attach the stay brackets between the Spiral Elevator column and the bottom frames.
- Remove feet from the now horizontal position and re-fit to the other holes in the frame to have the feet in the vertical position Fig. 16.
- Check and confirm that all screws and bolts in the lower frame, feet and stay brackets are in place and secure, Fig. 17.
- Lower the Spiral Elevator down on to the floor, Fig. 18.



Figure 15 Remount the part of frame removed from the top of column to the fixed frame at the base



Figure 16 Dismount the transport feet from the transport position and remount in correct holes



Figure 17 Assemble and fix the part of frame in to fixed base frame using the four bolts and nuts



Figure 18 Final result

- Move the Spiral Elevator to final position taking care not to place undue side load on the feet to avoid damage. If the Spiral Elevator is moved using a forklift or Pallet Truck, great care must be taken due to the height of the Spiral Elevator to ensure that it does not topple over.
- The Spiral Elevator can be adjusted to give the correct height see Section 5.1.1 'Floor attachment / construction'.

5 Mounting, installation, adjustment

This section deals with the installation and adjustments of the Spiral Elevator. Section 1 'Safety' should be read and understood before installation.

5.1 Provisions to be provided

5.1.1 **Floor attachment / construction**

When the Spiral Elevator is in the correct position, the Spiral Elevator should be set to the correct height and the column must be vertical. The adjusting feet can be used to set the Spiral Elevator to the correct height. If necessary, the connecting conveyors should be adjusted to this as well.

The feet should be fastened to the floor surface by using the holes in the adjusting feet and with fasteners suitable for the type of floor / mounting surface. Make sure all four feet are adjusted evenly.

It is not possible to change the difference in height between the lower and upper ends after the Spiral Elevator has been manufactured (i.e. the pitch between turns are fixed).

5.1.2 **Links to adjacent conveyor systems**

Any additional bracing of the Spiral Elevator in-feed and out-feed section must be provided. Following requirements are mandatory for a safe and correct installation of the Spiral Elevator in a conveyor system.

- Upper- and lower end must be connected to adjoining conveyors.
- The connecting conveyor to the lower end of the Spiral Elevator must leave adequate space to remove/insert the transport slats of the Spiral Elevator. A space of minimum 10 mm and maximum 25 mm is required.

If conveyors are to be attached to the Spiral Elevator they must be connected to the in-feed/out-feed section of the Spiral Elevator. Specially designed transfers are available from FlexLink.



Figure 19 Example of typical connection to an adjoining conveyor

5.2 Assembly

This paragraph describes a number of operations for Spiral Elevators that are not delivered fully assembled.

5.2.1 Gear motor

The gear motor may be delivered separately with the Spiral Elevator and then has to be mounted on site. A first check if all the required parts are present:

- Gear motor
- Grease
- Torque arm
- Key for shaft
- Fasteners (screw and washer)

The key and torque arm fastening to the frame may be preassembled.

Procedure:

Determine the installation orientation of the gear motor, according to Fig. 20.

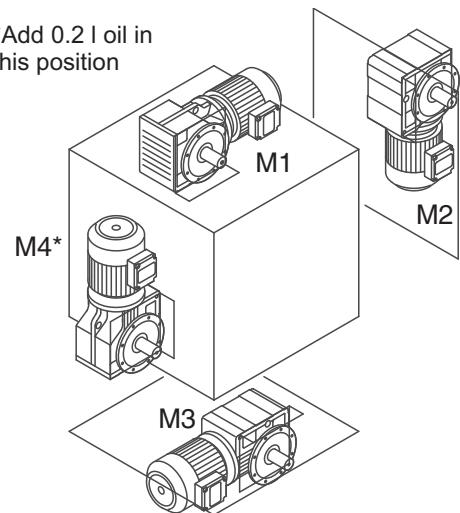


Figure 20 Mounting positions if motor is supplied from FlexLink

The conveyor and gear motor shown below are not necessarily the same type as supplied.

- Apply installation grease on the shaft to slide the gear motor onto the shaft easier and prevent any contact corrosion, Fig. 21.
- Attach the torque arm to the gear motor with appropriate fasteners see Fig. 22.
- Place the locking ring (circlip) in the gear motor or move to the desired groove in gear motor (if not already in the correct position), see Fig. 23.

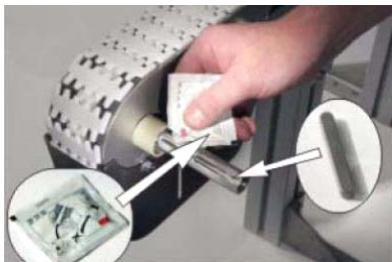


Figure 21 Applying grease on shaft.



Figure 22 Attaching torque arm.



Figure 23 Placing the locking ring.

- In the correct orientation, slide the gear motor (Fig. 24) on the shaft up til the locking ring (aligning the keyway to key).

- Add the torque arm washer (Fig. 25) before attaching the torque arm to the Spiral Elevator drive end see Fig. 26.



Figure 24 Sliding on the gear motor

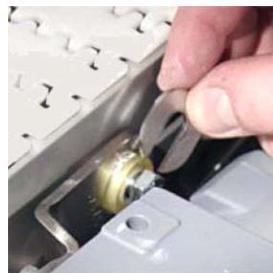


Figure 25 Add torque arm washer



Figure 26 Attaching torque arm

- Fasten the shaft to the motor with screw and washer inside the gear motor hollow shaft, Fig. 27. Place the cover to protect the opening (if cover is applicable), Fig. 28.
- Check all fastenings and remove excess installation grease, Fig. 29.



Figure 27 Fasten shaft to motor



Figure 28 Placing cover



Figure 29 Check installation

5.2.2 Mounting guide rail components

The basic Spiral Elevator does not include guide rail or brackets. Along the sides of the conveyor track there are M8 tapped holes typically every 45° to allow brackets to be attached.

The following describes how a typical FlexLink guide rail bracket system can be used on the Spiral Elevator. For final detail of the optimum guide rail and bracket arrangement consult FlexLink.

Procedure:

- Grind or cut off the small lugs on the FlexLink guide rail bracket (or distance piece) acc. to Fig. 30, before assembly.
- Attach the guide rail brackets to the frame. If an offset has been chosen, any distance piece has to be placed between the frame and the guide rail bracket.

- To attach the brackets to the conveyor sides, use M8 screws. The length depends upon the guide rail bracket arrangement used, but should not protrude in to the beam profile by more than 10 mm.
- With the brackets in place, the guide rail profile can be mounted to the brackets and clamps. Finished result in Fig. 31

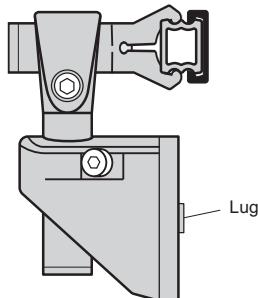


Figure 30 Lugs to be removed.



Figure 31 Connection mounting bracket

If the guide rail are FlexLink polyethylene, XLRs 3x15 P type, pre-bend a 150 mm long and 10x10 mm metal bar or an Ø10 mm metal rod to the radius of the guide rail and insert it in the guide rail at each end, to ensure rigidity (at the ends).

Make sure that there's a smooth connection between the guide rail joints, to ensure product passes along the guide rail unhindered. Products that are transported can make contact with the guide rail which may damage the guide rail. A damaged guide rail can result in products getting stuck or damaged. Check therefore that the guide rail is free from irregularities and adjust or repair if necessary.

The guide rail width setting can be adjusted at in-feed and out-feed ends of the Spiral Elevator in order to align with the feeding and receiving conveyors. This may depend upon which guide rail and brackets are fitted. It may be possible to 'flare out' the guide rails at the in-feed end of the Spiral Elevator.

5.3 Validation

Initially the validation checks should be for visual condition and dimensions. Subsequently an initial test run should be made with the Spiral Elevator in an unloaded condition.

5.3.1 Dimension check Spiral Elevator

The technical specification and / or relevant drawing can be used for the dimension check.

5.3.2 Adjusting and setting the Spiral Elevator, initial test run



Warning: *It is not recommended to make a test run with the machine while safety provisions have been deactivated or guards removed. Make sure there are no unauthorized persons near the Spiral Elevator.*

The initial test run is carried out according to Appendix A. Before the start of the initial test run, make visual checks for jammed parts or items touching the Spiral Elevator and stop immediately if any exist.

During the initial test run pay attention to the correct rotation direction of the chain, look at the behaviour of the chain and the operation of the drive. The chain should move evenly and without jerking motions.

If during the test run abnormal sounds are heard or if there is an impression that other irregularities occur, immediately switch off the Spiral Elevator, investigate and remedy the cause. The checklist in Appendix C and the troubleshooting list in Appendix E may be of assistance.

If the problem cannot be solved, please contact FlexLink for advice before continuing the integration.

When read and taken notice to the previous text, the initial test run and checks according to Appendix A, must be completed before any continuation.

5.4 Integration in a (transport) system

The Spiral Elevator is a machine that is integrated in a system of conveyors which means that an input and output are to be connected to it. If the Spiral Elevator is to be fitted into an existing application, this usually gives more problems with the installation than in a completely new line. Additional information regarding this is also found in Section 5.1.2.

5.4.1 Frequency control and check

The operation conditions are optimal when the speed of the Spiral Elevator is equal to the speed of the in-feed and out-feed conveyors or machines. If a speed difference does exist this can lead to product jamming at the transfers and wear of the high friction slats.

If there are speed differences which are unavoidable, these should be kept within a 10% margin. If the speed differences are higher than 10% then a frequency controller should be used for speed control. The settings or the ramp-up and ramp-down time should be set so that the Spiral Elevator does not "snatch" or "jerk" on starting or stopping.

<i>Chain length in Spiral Elevator</i>	> 30 m	< 30 m
<i>Speed Spiral Elevator</i>	50 Hz > 24 m/min 60 Hz > 28,8 m/min	50 Hz < 24 m/min 60 Hz < 28,8 m/min
<i>Total load in Spiral Elevator</i>	> 250 kg < 1 start and stop / hour	< 250 kg > 1 start and stop / hour
<i>Setting of the ramp-up and ramp-down should be set accordingly</i>	$T_1 = \frac{1,5 \times V}{60}$	If the speed difference is lower than 10% a frequency controller is <u>not</u> necessary.
<i>T₁ = ramp-down time [sec.]</i> <i>T₂ = ramp-up time [sec.]</i> <i>V = speed [m/min]</i>	$T_2 = \frac{1,5 \times V}{30}$	To get start and stop use a "Direct on Line" control instead.

After the integration the checklist in Appendix B must be completed to ensure a satisfactory integration.

5.5 Setting of the Spiral Elevator

The control setting for the Spiral Elevator needs to be done correctly, with particular regard to the ends and transfers to ensure good operation.

5.5.1 Controls

The table below gives some general guidelines with regard to the control system used to operate the Spiral Elevator.

Component	Setting	Remark
<i>Frequency control</i>	10%	The speed difference of the feeding conveyor to the Spiral Elevator or the Spiral Elevator to the receiving conveyor should generally be below the setting value. This is to avoid product twisting at the transfers and excessive slipping of the product on the conveyor or Spiral Elevator chain.
<i>Emergency stop switch</i>	Direct	The Spiral Elevator should be protected via an emergency stop circuit, such that if the relevant emergency stop button (or other) is activated, all power is removed from the Spiral Elevator gear motor, following which the Spiral Elevator may overrun a little (depending upon speed). The full details of the emergency stop circuit and procedure must be evaluated by the persons responsible for designing the control system.
<i>If Start / Stop via 'Direct on Line' control</i>	<3 sec.	The conveyor will start almost immediately and will stop and overrun a little (depending upon speed).
<i>If Start / Stop via Frequency controller (Inverter)</i>	2 sec.	See Section 5.4.1 'Frequency control and check'. In normal conditions the ramp-up and -down time in the frequency controller should be set to 2sec.
<i>Height / width detector</i>	Direct	Where over height or over width detection is incorporated, the stopping of the conveyor should be activated immediately with the stopping times suggested in the above items.

5.6 Test run

In this paragraph the Spiral Elevator will be checked with all safety provisions activated. Any issues with regard to the safety items should be investigated and discussed with the designer of the control and safety system.



Note! *The basic Spiral Elevator supplied by FlexLink does not include any additional safety provisions such as isolators, stop/start devices, emergency stopping systems or guards at the in-feed / out-feed ends.*

Should the safety provisions not function as expected, they should be set or adjusted again or repaired by the person responsible (installer/technician).

5.6.1 Method test run

Initially start the Spiral Elevator with no product loaded and conduct the items in the checklist below. Then gradually add product to the system up to 50% of the specified feed rate as detailed in the technical specification or quotations and conduct the items in the checklist again.

Gradually add more product to the system up to 100% of the specified feed rate as detailed in the technical specification or quotations and conduct the items in the checklist again.

If during any of the tests problems are detected, or if any of the following situations occur, the Spiral Elevator must be stopped, not to be tested further until the problem has been investigated / remedied and then the tests restarted.

- Irregular sounds
- Other irregularities / abnormalities
- Spiral Elevator does not meet specifications
- Some of the product do not fit on the Spiral Elevator
- Product become stuck or slip

When read and taken notice to previous text, the test run and checks according to Appendix C must be completed. It contains details of the main items to check when the test runs is carried out.

6 Technical maintenance

Good maintenance will prolong the life of the Spiral Elevator and help to reduce any costs resulting from breakages or downtime. If maintenance is not performed as recommended the warranty will not apply.

Before any maintenance functions are carried out on the Spiral Elevator the power supply to the gear motor must be safely isolated. This always applies for any maintenance of the Spiral Elevator.



Danger: *Before any maintenance functions are carried out, make sure that the main switch has been switched off, and safely isolated, in order that there is no possibility that the Spiral Elevator can be started unexpectedly.*

It's necessary to perform maintenance activities according to the methods described. During maintenance proper and safe tools must be used. Before disassembling any part please refer to Section 5 'Mounting, installation, adjustment', in this manual.

6.1 Slats

6.1.1 Checking slats

The slats may partly break off (see Fig. 32) or be pushed from the chain. It may be the result of the products becoming jammed. If missing or broken slats are detected, these are to be replaced. Dirt or product labels sticking to the slats may also make the slats to break or become loose. It is therefore necessary to regularly check and clean the Spiral Elevator. Make sure to find all parts of the broken slats to ensure that they don't get stuck or jammed inside the Spiral Elevator.



Figure 32 Example of a broken slat

6.1.2 Replacing slats



Note! Damage on the products transported or on the Spiral Elevator may occur if the slats are incorrectly mounted.

The flaps on the underside of the slats are suited for one time use only. Disassembly of the slats from the steel chain can cause damage to the flaps and therefore it is not recommended to re-use slats. If a slat breaks, make sure to find all the broken parts to ensure that no parts get left behind or stuck inside the Spiral Elevator.

Each 5 metre of steel chain is connected by two connecting links. To locate these links, the slats above them are marked with red dots. Make sure that the correct slats are replaced back onto the chain, possibly marking them.

If a slat is replaced because of a missing slat, the chain tension should be checked.

Procedure:

- Make sure that the main switch has been switched off, and safely isolated.
- The slat can be replaced at the lower end of the Spiral Elevator.
- The slat is clicked onto a connection link with two lugs underneath and can be removed from the steel chain by spreading these lugs. Pull back on both tips of the slat while keeping your thumbs pressed on the centre of the slat, Fig. 33 and Fig. 34. The slat lugs will now be spread so that it can be pulled from the steel chain see Fig. 35. Repeat this procedure if more than one slat needs to be removed.



Figure 33 Press thumbs on the centre of the slat.



Figure 34 Increase pressure on centre of slat to make the lugs to spread.



Figure 35 Slat removed.

- New slats can now be placed on the steel chain. Make sure that the slat is always placed on the connecting links of the steel chain and that the bearing on the slat is placed on the column side of the track. Pull back on both tips of the slat while keeping your thumbs

pressed on the centre of the slat, Fig. 35. The slat lugs will now be spread so the slat can be placed on the steel chain (reverse "removing" procedure).

- Apply force on the middle of the slat so that it clicks onto the steel chain according to Fig. 33 and Fig. 34 (reverse "removing" procedure). Repeat this procedure if more than one slat needs to be placed.
- After maintenance on the slats, test run the machine and check if the chain and slats runs correctly.

6.2 Chain

6.2.1 Checking chain tension

The chain of the Spiral Elevator must have the correct tension. If the tension is not correct, the following may occur:

- Chain runs off the sprocket (jumps a cog).
- Slats grab into the return track causing them to break or become loose from the chain.
- Excessive wear of the end sprocket caused by too high tension.

In order to prevent these problems, it is necessary to regularly check the chain tension for over length.

Procedure:

- Make sure that the main switch has been switched off and safely isolated.
- Move the chain along the sticker with a scale, at the lower end of the Spiral Elevator. The scale contains a red and a green area see Fig. 36.
- Compress the transport belt according to A in Fig. 36.
- Take a reference point of one of the slats according to B in Fig. 36.
- Stretch the transport belt according to C in Fig. 36.
 - If the slat is moving within 40-100 mm on the sticker, the chain is to long and CAN be shortened.

- If the slat is moving beyond 100 mm on the sticker, the chain is too slack and MUST be shortened. This doesn't mean that the steel chain must be replaced.

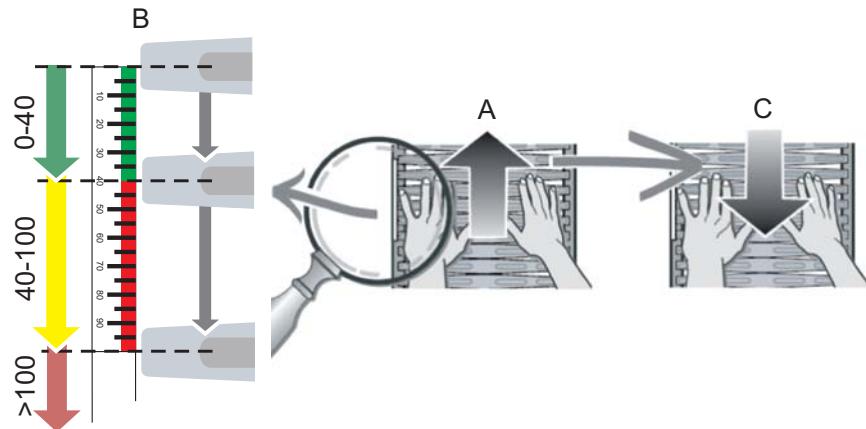


Figure 36 Distance check for over length

6.2.2 Shorten steel chain

If the chain stretch exceeds the limit of 100 mm, according to Fig. 36, the steel chain must be shortened. Shortening the steel chain should be done at the lower end. FlexLink delivers a chain tensioner with the machine to assist in this procedure.

Procedure:

Every 5 m the steel chain is connected with two connecting links. The slats located above these links are marked with two red dots. The steel chain can easily be shortened by removing one of these two connecting links.

- Create access to the steel chain by removing the slats with the red dot plus several slats either side. The slats are removed at the end of the lower end unit. The procedure for slat removal is detailed in Section 6.1.2. The chain will need to be moved around to access the slats and the procedure for this is detailed in Section 6.2.4.
- Remove the security locks from both connecting links. Once these have been removed the gold colored plates and the connecting link on the steel chain can be removed.
- If possible, place the chain tensioner at both loose ends of the steel chain and turn it until both ends meet see Fig. 38.
- Replace one connecting link (including the security lock) and the steel chain is then shortened. Return the chain back to the service location and replace chain with new slats. Make sure you place a marked slat over the connecting link on steel chain.

- If the steel chain is still too long, repeat this procedure at another location which still has two connecting links. At least one connecting link must remain at each relevant location.



Figure 37 Working room lower end.



Figure 38 Tensioning the steel chain.

6.2.3 Check chain stretch

Procedure:

- Make sure that the main switch has been switched off and safely isolated.
- At the idler or drive end of the Spiral Elevator, stretch at least 8 slats apart.
- Measure the distance between the start of slat 1 and the start of slat 8 (i.e. the pitch across 7 slats - see Fig. 39). For a new chain this distance is 267 mm.
- Therefore the steel chain must be replaced when the measured distance is more than 271 mm.
- Refer to Appendix F for spare part numbers and contact FlexLink to procure the necessary parts.
- If the chain will be replaced, make sure to also replace a new sprocket.

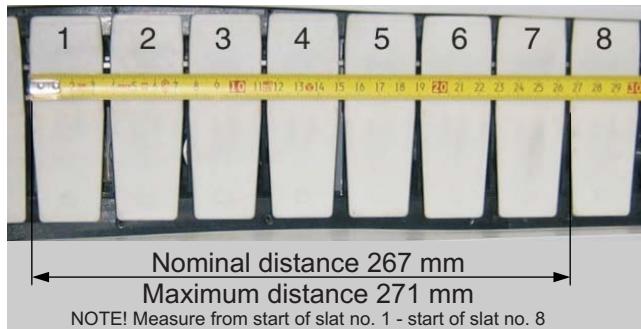


Figure 39 Tape measure on chain

6.2.4 To move the chain within Spiral Elevator

To shorten the steel chain the slats with colored dots must be removed see Fig. 33, Fig. 34 and Fig. 35. This is done by moving these slats to the end of the lower end unit.

Procedure:

- Make sure that the main switch has been switched off, and safely isolated.
- Ensure that the Spiral Elevator is free of products.
- Release the brake if present on the gear motor so the chain can move freely.
- Depending upon the ratio of the gear motor it may be necessary to remove the gear motor.
- Check the chain moves in the Spiral Elevator smoothly.



Note! *If the rotation feels very heavy it's possible that the chain is jamming somewhere. Check the chain and remove any possible obstruction. Make sure the brake is released.*

6.2.5 Replace steel chain

If the steel chain is too long or doesn't run smoothly it has to be changed and thereby also have to change the sprocket wheel.

Procedure:

- Make sure that the main switch has been switched off, and safely isolated.
- Ensure that the Spiral Elevator is free of products.
- Release the brake, if present, on the gear motor so the chain can move freely.
- Depending upon the ratio of the gear motor it may be necessary to remove gear motor.
- Remove the slats with the red dots on and then open up the steel chain by removing one of the locking links. Pull out all chain from the Spiral Elevator at the lower end.
- After changing sprockets, put in new pre-mounted chain at the lower end.

- When the chain and all slats are in place start up the Spiral Elevator and make sure it runs smoothly and that no noise occur.

6.3 Products sliding

One of the conditions that apply to the Spiral Elevator is that products being transported should not slide.

6.3.1 Checking for products sliding

The surface on top of the slats have high friction material to avoid sliding and therefore it should be checked according to Appendix D.

Observed sliding may have different causes, for example:

- Worn high friction surface on slats which then needs to be replaced with new.
- Contamination on the Spiral Elevator, slats or product. This foreign matter must be removed by cleaning.

6.4 Sprocket wheel

6.4.1 Align sprocket wheel at lower or upper end

If the Spiral Elevator does not run smoothly or is noisy, one of the sprocket wheels at the ends may not be aligned correctly. This may cause extra wear of the steel chain and sprocket wheel.

Procedure:

- Make sure that the main switch has been switched off, and safely isolated.
- Remove 7-8 slats at the lower end so that the sprocket wheel is visible, see Fig. 40 and Fig. 41. It's only possible to remove slats at a small area at the lower end and therefore you have to toggle the Spiral forward for removal of more slats. (Two slats can be removed before toggling is necessary.)
- In lower end, measure the distance from the side plate to the middle of the steel chain as seen in Fig. 40. To adjust the sprocket wheel, release the socket head screw (Fig. 42) and then move it to correct position. Don't forget to tighten it after the adjustment. To check the upper end, run the Spiral until the part of the steel chain with no slats appears in the upper end (see Fig. 41) and then measure and make the adjustment if necessary. Correct measure upper and lower end: 49 ± 1 mm.

- Replace the removed slats after the adjustment. In the upper end, run the spiral until the steel chain is visible in the lower end and mount the slats.

When all slats are in place, start the Spiral Elevator and make sure it runs smoothly and that no noise occur.

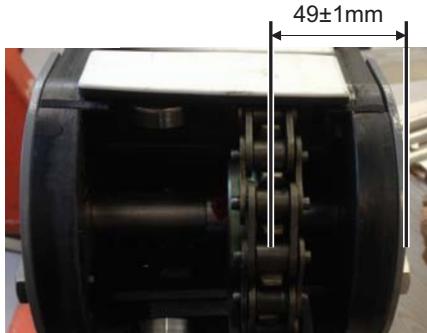


Figure 40 Lower end

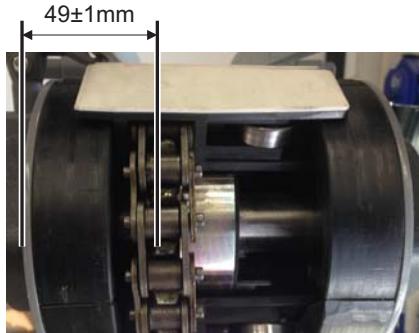


Figure 41 Upper end

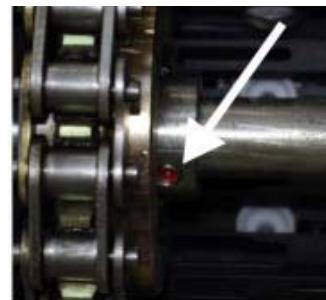


Figure 42 Socket head screw

6.4.2 Replace sprocket wheel, upper end

Procedure:

- Make sure that the main switch has been switched off, and safely isolated.
- Remove guides at upper end.
- Remove the slat with the colored dot. Under this slat there is a locking link and the steel chain can be separated here. The sprocket wheel is now released from the steel chain.
- Dismount the gear motor from the shaft. This is done by removing the screw mounted in the hollow shaft of the gear motor according to Fig. 43.
- After this the screw that's connecting the torque arm (Fig. 44) with the Spiral Elevator should be loosened. The gear motor can then be removed, Fig. 45.



Figure 43 Dismounting of screws



Figure 44 Screws torque arm



Figure 45 Motor removed

- Once the gear motor has been removed, the grub screw in the locking rings of the bearing blocks (Fig. 46) can be loosened. The bearing blocks can then be removed and slid off of the ends of the shaft.
- The shaft with sprocket wheel can then be removed from the end unit see Fig. 47.



Figure 46 Bearing block with locking



Figure 47 Shaft with sprocket wheel ring.



Note! *The shaft and sprocket are removed as one piece. Make note of the orientation of the sprocket wheel on the shaft before replacing it.*

- Re-fitting is the reverse procedure of the removal.
- After assembly the Spiral Elevator must be set up according to Section 5.5, then test runned and checked according to Section 5.6 and Appendix C, to ensure correct run.

6.4.3 Replace sprocket wheel, lower end

Procedure:

- Remove the slat with the colored dot. Under this slat there is a locking link and the steel chain can be separated here. The sprocket wheel is now released from the steel chain.
- Remove the slide rails to allow necessary space for subsequently remove shaft and wheel (Fig. 48).
- Loosen the central screw on each side of the shaft at the lower end (Fig. 49)

- When the screws are removed, the shaft with the sprocket wheel can be lifted / slid out, Fig. 50.

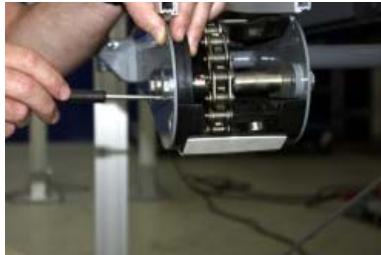


Figure 48 Dismounting of slide rails



Figure 49 Dismounting of shaft



Figure 50 Sprocket wheel released from steel chain



Note! The shaft and sprocket are removed as one piece. If replaced as individual items make note of the orientation of the sprocket wheel on the shaft.

- Re-fitting is the reverse procedure of the removal.
- After assembly the Spiral Elevator must be set up according to Section 5.5, then test runned and checked according to Section 5.6 and Appendix C, to ensure correct run.

6.5 Slide rail

6.5.1 Maintenance of the slide rail

Checking of the slide rail must be done at the location where the most pulling force is present. This position is just before the drive shaft. Check monthly for following in Fig. 51, Fig. 52, Fig. 53 and Fig. 54. If one of these are noticeable then the slide rail of the entire Spiral Elevator should be replaced

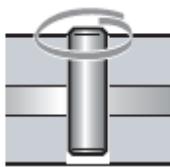


Figure 51 Pin sticking out

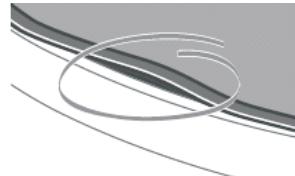


Figure 52 Slide rail coming loose of the profile from the frame

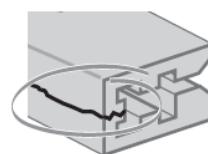


Figure 53 Cracks inside the profile

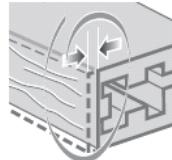


Figure 54 Pressure damage at the contact point by the bearing

Cleaning of the slide rail must be done with a non-aggressive cleaner (mild soap) or a Teflon based oil, see Fig. 55. Never use a silicone based cleaner.

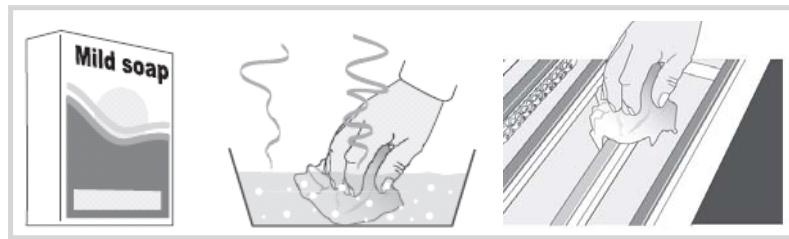


Figure 55 Cleaning procedure

6.5.2 Replacing the slide rail

Replacing the slide rail should be done as follows. The spring pins are placed with two springs in each end of the slide rail and with a CC distance of 20 mm. The following pins are placed with one pin every 300 mm according to Fig. 56.

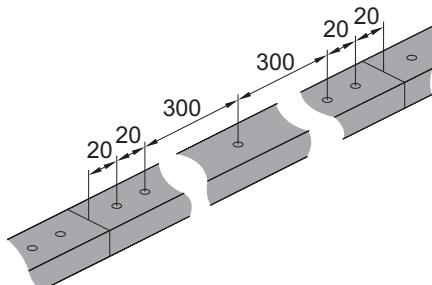
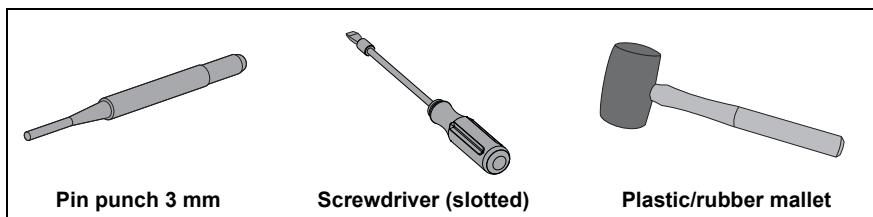


Figure 56 Positioning of spring pins [mm]

Recommended tools:



Procedure:

Make sure that the spring pins are well driven inside the slide rail and not sticking out on the top or bottom.

- Punch out the spring pins with a pin punch 3 mm and a hammer according to Fig. 57.
- Bend off the slide rail with an flat-ended screwdriver for example Fig. 58.
- Push on the new slide rail according to Fig. 59
- Replace the spring pins. Make sure that the spring pins are well driven inside the slide rail and not sticking out in top or bottom (Fig. 60).
- It's recommended to check the slide rail with an piece of one meter transport belt.

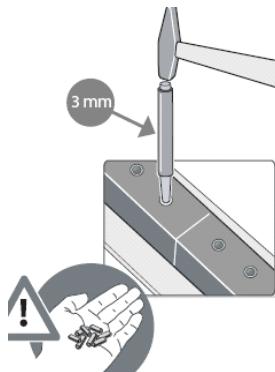


Figure 57 Punch out pins

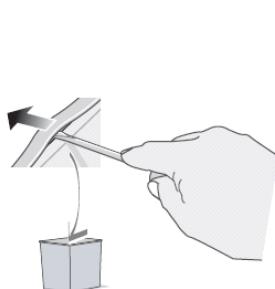


Figure 58 Bend off slide rail

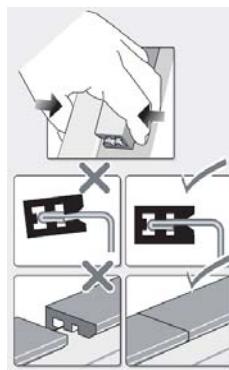


Figure 59 Mount new slide rail

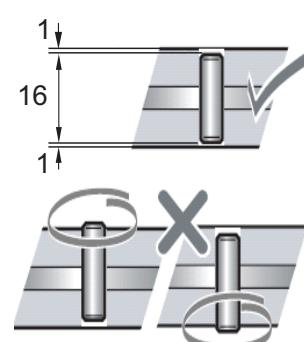


Figure 60 Replace spring pins

6.6 Maintenance schedule Spiral Elevator

The list in Appendix D, lists the general maintenance operations which must be carried out at the normal time intervals for those maintenance operations.

The maintenance intervals are for a Spiral Elevator operating in normal conditions with single shift working (8 hours per day) and in a normal environment. For more working hours or for an environment which has more dirt or abrasive particles around or on the Spiral Elevator, the end user must decide upon the appropriate maintenance intervals taking in to account all of the conditions.

To achieve good working life from the Spiral Elevator the various maintenance items must be done correctly and at the correct time intervals.

Only replacement parts detailed within the recommended spare parts listing detailed in Appendix F should be used. The use of other parts which are not detailed within the spare parts list will invalidate the warranty.

For any warranty issues for the Spiral Elevator, all of the maintenance operations and times must be fully documented and kept in a suitable maintenance log or the warranty will be void.

6.7 Cleaning and maintenance procedure Spiral Elevator



Danger: *Make sure that the main switch has been switched off, and safely isolated.*



Warning: *Do never attempt to climb the machine to reach higher levels but use adequate and approved climbing materials.*

The Spiral Elevator consists of a steel coated frame, steel chain, shafts and other components.

A regular scheduled cleaning of the Spiral Elevator will extend the lifetime of the machine and contribute to the overall line efficiency in which the unit is integrated. In time the machine will collect dust and debris particles inside the machine, affecting the chain, slide rails, bearings and the friction of the slats thus increasing the risk of downtime and maintenance cost.

The loss of friction on the chain will eventually result in an inconsistent product flow impacting the efficiency of subsequent equipment.

Furthermore the products transported on the Spiral Elevator may carry debris over from preceding equipment in the line. We recommend to eliminate this carry over as much as possible to ensure a consistent throughput.

6.7.1 Cleaning procedure:



Note! *Improper or insufficient cleaning will void the warranty!*

Clean the machine with a damp cloth and mild soap solution. Do not wash or rinse down with water. The chain, including the friction inserts can be cleaned with white spirit. Do not use scrapers or knives on the coated parts or chain surface. Cleaning interval according to Appendix D.

- All cleaning products must be applied according the manufacturer's instructions.
- Maximum water temperature is 60°C (140°F).
- Do not spray directly on electrical components, bearings, lubrication systems, chain and stickers.

7 Put out of commission

Decommissioning should be undertaken in a safe and controlled manner. This section details the items which must be done for this decommissioning.

While dismantling the machine, the regulations for waste processing applicable for the country and local authorities at the time of the dismantling are to be complied with.

The machine only contains commonly known materials. At the time of assembly and delivery of the Spiral Elevator there were processing possibilities for these materials and no particular risks were known for persons involved in the dismantling process.

7.1 Disconnect the power sources



Danger: *First switch off the main switch before the power source may be disconnected.*

The main power isolator must be turned off and 'locked off' or power permanently removed from the isolator. If the isolator is mounted on the Spiral Elevator the power supply must be permanently removed from the isolator.

This is to ensure that there can be no electrical supply to the gear motor connections either before or after the gear motor is removed.

7.2 Disassemble

The disassembly of the Spiral Elevator generally requires few operations. Depending upon the height of the Spiral Elevator it may be required to lay the Spiral Elevator horizontal. If this is necessary the procedure for this is generally the reverse of the procedure used to stand up the elevator detailed in Section 4.2.1.

7.3 Transport



Note! *A transport frame / base should be used which is similar to the unit used for the initial delivery of the Spiral Elevator.*

While transporting the Spiral Elevator a number of safety measures are to be taken.

Use the same tools and equipment as indicated in Section 4 for the Unloading of the Spiral Elevator.

A suitable Method Statement and Risk Assessment for the dismantling and transportation should be done by the relevant responsible person. This Method Statement should be followed throughout the decommissioning process.

Transport of the Spiral Elevator in the vertical or horizontal mode depends upon the access route, vehicle height and general height of the Spiral Elevator. As a guide, all Spiral Elevators with a total height above 2.4 m should be transported in the horizontal mode.

7.4 Disposal

If the Spiral Elevator is to be disposed of, then all current regulations for the country and local authorities must be adhered to.

The main materials within the Spiral Elevator can vary depending upon the design of the Spiral Elevator and any accessories attached to the Spiral Elevator (such as guide rail parts).

7.5 Reuse



Note! *Putting the Spiral Elevator out of commission or in to a new use must only be carried out by technically qualified personnel.*

If the Spiral Elevator is to be re-used for another application, then full details must be checked to establish whether the Spiral Elevator is suitable for this new application. Clarification for the new application should be sought from FlexLink (though there may be a charge for this service). A full Risk Assessment will need to be completed for the use in the new application before the Spiral Elevator can be put in to service.

8 Supplier's information

This document was drawn up by:

FlexLink AB

Date: 2015/02/12

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The machine was supplied by:

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Note! *In case of failures please contact the system integrator.*

A Checklist- Initial test run



Note! Before the initial test run is carried out, make sure that Section 5.3.2 on page 26 is read, understood and followed. If any questions or problems occurs and can't be solved, please contact FlexLink before continuing the integration.

Step	Test	Checks	Duration	Carried out
1.	<i>Visual check</i>	Check for jammed parts or items touching the Spiral Elevator chain links and do not start, or stop immediately, if this is the case. Make sure to remove items and continue.	-	Yes / No
2.	<i>Start the Spiral Elevator (at 10 Hz if variable speed motor).</i>	Check the rotation direction of the chain. If this is not correct, then make necessary adjustments to the electrical control circuit or system.	-	Yes / No
3.	<i>Run the Spiral Elevator (run at 10 Hz if variable speed motor).</i>	Check whether the slats have been mounted correctly, and that chain and slats run evenly over the slide rail. Check whether the chain runs smoothly and without any abnormal or significant noises. The chain should move evenly and without jerking motions. Look at the behavior of the chain and operation of the drive. If any problems, switch off the Spiral Elevator immediately and investigate and remedy the cause using Appendix C and/or the troubleshooting list in Appendix E.	10 minutes	Yes / No
4.	<i>Run the Spiral Elevator at 25 Hz (if variable speed motor).</i>	Repeat the checks in step 3 above.	10 minutes	Yes / No
5.	<i>Let the Spiral Elevator run at the nominal speed described in the technical specification or detailed within the quotation.</i>	Check for peculiar sounds or unusual movements related to the Spiral Elevator. Repeat the checks in step 3 above.	10 minutes	Yes / No
6.	If all of the items above have been complete and the Spiral Elevator runs satisfactorily, then the remaining parts of the overall system can be checked and the overall subsequently run described.			Yes / No

B Checklist - Integration in a (transport) system

After the integration the checklist given below should be completed to ensure a satisfactory integration.

Component	Remark	Checked
<i>Lower end</i>	<p>Is the lower end at the correct height and is the distance to the adjacent conveyor / machine satisfactory (should be >10 mm and < 25 mm, and suitable for other considerations regarding product transfer and safety)?</p> <p>For correct height refer to technical specification (Section 2), quotation details or drawings.</p>	Yes / No
<i>Upper end</i>	<p>Is the upper end at the correct height and is the distance to the adjacent conveyor / machine satisfactory (should be below 25 mm and suitable for other considerations regarding product transfer and safety)?</p> <p>For correct height refer to technical specification (Section 2), quotation details or drawings.</p>	Yes / No
<i>Spiral Elevator</i>	Is there sufficient space around the Spiral Elevator to allow adequate access for operation and maintenance?	Yes / No
<i>Fastening / foundation</i>	Is the Spiral Elevator fixed to the floor satisfactorily and is the central column vertical?	Yes / No

C Checklist - Test run



Note! Before the test run is carried out, make sure that Section 5.6 on page 28 is read, understood and followed. If any questions or problems occur or can't be solved, please contact FlexLink before continuing.

No.	Check	Remarks	Passed
Start test run with <u>no product loaded</u> and check following			
<i>If any problems are detected or occurs, the Spiral Elevator must be stopped and cannot be tested further until the problem has been investigated / remedied and the tests restarted.</i>			
1.	<i>Does excessive noise occur?</i>	Can be due to incorrect tension of the steel chain, slats are loose or a sprocket wheel is not aligned (see Appendix E).	Yes / No
2.	<i>A 'ticking' sound is present?</i>	Can be due to incorrect tension of the steel chain, slats are loose or a sprocket wheel is not aligned (see Appendix E).	Yes / No
3.	<i>Are any slats moving unexpectedly at any position throughout the Spiral Elevator?</i>	Can occur if some slats are loose (see Appendix E).	Yes / No
4.	<i>Are there any slats which are raised at any position?</i>	Can be due to loose slats or if a sprocket wheel is not aligned (see Appendix E).	Yes / No
5.	<i>Are there any damaged slats or is there friction material missing?</i>	If so, the slats must be replaced (see Section 6.1.2).	Yes / No
6.	<i>Are slats touching the frame, the guide, the guard or anything else?</i>	Adjust the guide or the guard and carefully check the correct setting / dimension of this.	Yes / No
7.	<i>Do all products fit on the chain?</i>	Check in the Section 2.1, quotation or drawing for specified product dimensions.	Yes / No
8.	<i>Do any products slide off of the chain?</i>	Are the conditions, sizes and weights of the products correct according to Section 2.1, quotation or drawing? Is there any 'foreign substance' on the product or Spiral Elevator reducing the effect of the friction material? (see Section 6.7) Sliding of products should never occur, check Appendix E and if problem still remains contact FlexLink.	Yes / No
9.	<i>Are there any products that do not continue on or off the transfer of the Spiral Elevator?</i>	Check the condition of transfers. Any transfers supplied as part of the system are in addition to the standard Spiral Elevator and generally these transfers are not powered, therefore some product may remain on the transfer (depending upon various factors such as speeds, condition, size or weight of product).	Yes / No

No.	Check	Remarks	Passed
10.	<i>Is the product oriented correctly during transportation on and off the transfer of the Spiral Elevator?</i>	The design of the adjoining equipment should be checked.	Yes / No
11.	<i>Is the product properly transported throughout the Spiral Elevator?</i>	Generally the product will not twist whilst travelling up or down the Spiral Elevator. If undue twisting does occur, contact FlexLink.	Yes / No
12.	<i>Are there any protrusions or irregularities along the guide rail?</i>	The product should not stick or jam against the guide rail. (see Appendix E)	Yes / No
13.	If all items above have been complete and the Spiral Elevator runs satisfactorily, gradually add products up to 50% of the specified feed rate as detailed in the technical specification or quotations and then perform step 1-12 again.		Yes / No
14.	If all items above have been complete and the Spiral Elevator runs satisfactorily, gradually add products up to 100% of the specified feed rate as detailed in the technical specification or quotations and then perform step 1-12 again		Yes / No

Safety provisions

Should the safety provisions not function as expected, they should be set or adjusted again or repaired by the person responsible (installer / technician).

No.	Check	Remarks	Passed
1.	<i>Does the stop button stop the Spiral Elevator within the time expected.</i>	Both the Spiral Elevator and the input/output chain should stop immediately within the time dictated in the control design specification or within 3 seconds depending upon speed.	Yes / No
2.	<i>Does the Spiral Elevator stop when the emergency stop is pressed.</i>	The Spiral Elevator should stop immediately and this should be less than 3 seconds depending upon speed.	Yes / No
3.	<i>Does the optional height / width indicator reacts when processing a product which is too large.</i>	The height / width detector should react when a product is coming by that is larger than the specified product mentioned in Section 2.1 or quotation.	Yes / No

D Maintenance schedule



Note! Before any maintenance, make sure that Section 6 and Section 6.7 is read, understood and followed.

No.	Execution	Interval	Remark
1.	<i>Clean conveyor</i>	Monthly	Regular cleaning depends on product and environment.
2.	<i>Check the chain for broken or missing slats</i>	Daily	It is the task of the operator to do this check. Replace if necessary, see Section 6.1 for details.
3.	<i>Check the chain tension</i>	Monthly	Remove a link if the chain too long, see Section 6.2 for details. If more than two links at the same time are to be removed, contact FlexLink.
4.	<i>Check the sprocket wheel and it's alignment.</i>	Monthly	Faulty alignment of the sprocket may cause permanent wear or make the steel chain derail which may cause serious stoppages. Replace or align if necessary, see Section 6.4.
5.	<i>Check the guide rails for dents, damages and connection</i>	Monthly	Replace guide rail components if they have any impact on the products to be transported. If the cause is bad guide rail, contact the FlexLink. For more details see Section 5.2.2
6.	<i>Clean inside below ends</i>	Monthly	Accessible dirt will accumulate at the bottom side, see Section 6.7
7.	<i>Check the drive for oil leakage and undue noise</i>	Monthly	Repair or replace if necessary. See the Appendix E.
8.	<i>Check whether the Motor is fastened well to the Spiral Elevator</i>	Monthly	Tighten the screws if necessary. Drive vibrations can make screws to come loose, then faulty alignment of the drive can bend the shaft and the steel chain may derail.
9.	<i>Check the oil level in the Motor</i>	Monthly	Take a look at the gear motor specifications of the manufacturer, fill up if necessary.
10.	<i>Change the oil in the Gear motor</i>	In accordance with the gear motor specifications of the manufacturer	
11.	<i>Clean slats</i>	Daily	See Section 6.7 'Cleaning and maintenance procedure Spiral Elevator'
12.	<i>Remove several slats and all covers to clean the slide rails</i>	Every two weeks	Removal of slats see Section 6.1.2. Cleaning of slide rails see Section 6.5.1.
13.	<i>Remove chain to clean the inside, the guide rails and chain</i>	Every half year	Replace steel chain see Section 6.2.5

14.	<i>Check products sliding</i>	Daily	Sliding products may damage the Spiral Elevator or components of it, which can lead to downtime. See Section 6.3
15.	<i>Check slide rails for pins sticking out, rails coming loose from profile, cracks, or pressure damages</i>	Monthly	Replace any broken or faulty slide rails. See Section 6.5.
16.	<i>Check smooth and even motion of chain in the Spiral Elevator</i>	Daily	Troubleshoot and trace the relevant components.

E Troubleshooting list

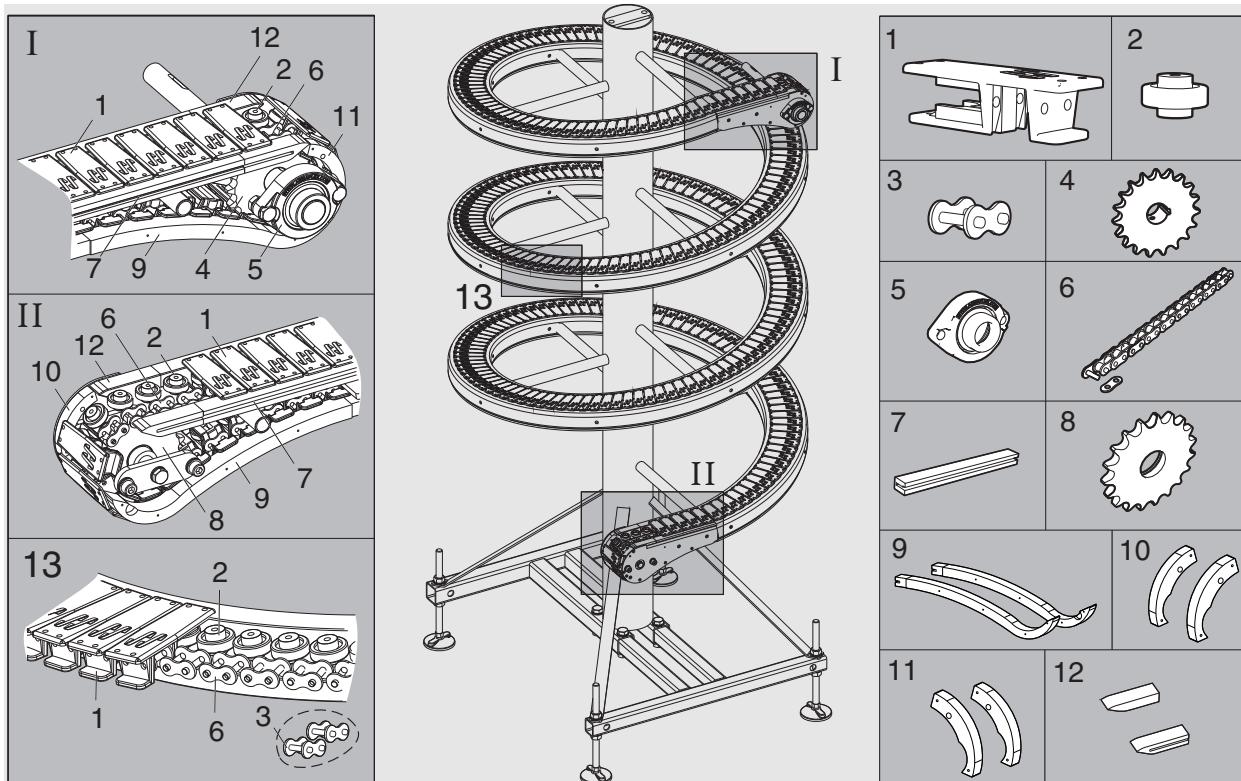
If no solution of the existing problem can be found or fixed, contact FlexLink. The warranty will not apply if the instructions in this manual is not followed.

No.	Trouble	Possible cause	Solution
1.	<i>Spiral Elevator doesn't start</i>	No power (volts) at the gear motor	The cause for lack of power to be investigated by qualified personnel.
		Gear motor defective	Replace the motor.
2.	<i>The motor is running but the Spiral Elevator doesn't work</i>	Worn teeth on the sprocket wheel	Replace the sprocket wheel and also the entire steel chain see Section 6.2.5.
		The steel chain is not located on the sprocket	Realign the sprocket, and investigate the cause.
		Product jamming the Spiral Elevator	Remove the product jam and check the width / height detectors (if fitted).
		Product weight overload / too much product or weight on the Spiral Elevator	Remove product and operate within the specification limits in Section 2.1.
		Broken steel chain	Repair or replace the steel chain (see Section 6.2.5) and check sprockets.
3.	<i>Broken or misaligned slats</i>	Product jamming the Spiral Elevator	Remove the product jam and check the width / height detectors (if fitted). Replace slats see Section 6.1.2.
		Irregularities on slide rail	Repair or replace the relevant slide rail. Replace slats see Section 6.1.2.
		Foreign objects / material on chain	Remove the foreign objects. Replace slats see Section 6.1.2.
		Chain too long, which makes the slats grab at the entry to the underside return guide	Shorten the steel chain. Replace broken slats see Section 6.1.2.
4.	<i>Product stops due to defective slats</i>	Missing or defective slats.	Replace defective slats.
5.	<i>Product jams beneath guide rail</i>	Guide rails not set correctly	Set guide rails to correct height.
		Product height is too low for guide rail	Check if product is meeting the specifications in Section 2 or contact FlexLink.

No.	Trouble	Possible cause	Solution
6.	<i>Product stops at beginning or end of the Spiral Elevator</i>	Product orientation	Check cause of products incorrect orientation.
		Defective transition roller arrangement (if fitted)	Contact FlexLink.
		The product is pushed to the outside, because there is no space between the products on the Spiral Elevator.	The feed rate of the product is too high for the Spiral Elevator speed. Check to see if / why the feed rate is above the specification or why the Spiral Elevator speed is below the specification. Typically the products should have a minimum distance between of 25% of the product length.
		Poor alignment of the products	Align the product before the Elevator.
7.	<i>Chain too long</i>	Combination of speed and continuous load of product stoppage	Shorten the steel chain.
8.	<i>Poor product transfer on or/and off the Spiral Elevator (depending on product & specification, the actual transfer may vary).</i>	Product stoppage	Repair the transfer unit if faulty
		Product load too high	Check the specification in Section 2 for the maximum product weight or contact FlexLink.
		Transfer unit not aligned correctly	Align the transfer unit.
		Transfer unit dirty	Clean the transfer unit.
9.	<i>Oil leaking on the seal between drive shaft and motor</i>	Torque arm locked too tightly, which may cause torsion between shaft and motor shaft hole	Replace the seal and look whether the mounting causes the problem.
		Gear motor becoming too hot due to overload	Check cause of overload and remove. Replace gear motor or seal.
10.	<i>Noise level from the Spiral Elevator is above normal</i>	Sprocket wheel not aligned	Align sprocket wheel.
		Chain tension	Check the chain tension and shorten the steel chain if necessary.
		Broken slats	Check chain and replace the slat(s).
		Oil level on gear motor	Contact the gear motor manufacturer.
11.	<i>Products sliding</i>	Worn high friction surface on slats	Replace the affected slats.
		Contamination on Spiral Elevator, slats or on product	Clean the contaminated parts, investigate and correct the source of the problem.

F Spare parts list Spiral Elevator

Use of other parts which are not detailed within the spare parts list will invalidate the warranty.



Item	Description	Part No	Qty	Comments	Recommended spare parts
1	Slat kit	5119707	1	20 pcs	
2	Bearing kit	5112486	1	20 pcs	
3	Connection link kit	5112487	1	3/4" steel, 5 pcs	
4	Sprocket wheel	5112488	1	3/4" 19T for shaft 30 mm	
5	Bearing	5112489	1		
6	Steel chain	5112491	1	3/4" Side flexing L=5 m 8no (connecting links included)	
7	Slide rail kit	5112492	1	20 meter slide rail 24x18, single ditch SV with 12 pins, 3 mm drill bit	
8	Sprocket wheel	5112493	1	3/4" 19T for shaft 20 mm	
9	Slide guide kit	5116179	1	L+R guide, 12 pins, drill bit and assembly instruction	
A *)10	Guide kit lower	5119549	1		
	(*10) Guide	(5115568)	2		
B *)11	Guide kit upper	5119550	1		
	(*11) Guide	(5117173)	2		
12	Guide rail kit	5119551	1	L+R	
13	Chain (pre-mounted) kit	5120032	1	Pre-mounted chain. L=5 m, 2 connecting links (slats, bearing, connections link, steel chain)	

